Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended and new claims added to further clarify Applicants invention. No new matter has been added.

For example support for the amendments is found in the previously presented claims as well as the Specification at:

[0035] The flowing process for the carbon dioxide 214 into the supercritical cleaning chamber 208 is continued until the carbon dioxide 214 fills up the cleaning chamber 208. The pressure and temperature are increased in the supercritical cleaning chamber 208 such that the carbon dioxide 214 in the supercritical cleaning chamber 208 is maintained in a supercritical state: at a temperature of 310-500 degrees C and a pressure of 1500-1000 psi. The density of the carbon dioxide 214 in the supercritical cleaning chamber 208 is 500-900 kg/m^3. **The carbon dioxide 214 in the supercritical cleaning chamber 208 circulates inside the chamber 208 to improve the cleaning effect. The circulation speed inside the chamber 208 is 0.5-3 meter/sec.**

Claim Rejections under 35 USC 102

1. Claims 1-2, and 6-9 stand rejected under 35 USC 102(e) as being anticipated by Inoue et al. (US 6,962,161).

Inoue et al. disclose a cleaning process including **continuous flow** of **supercritical carbon dioxide cleaning fluid** through a pressurized cleaning chamber (see Abstract). The carbon dioxide is transformed into a supercritical state together with additives and a co-solvent **upstream of and prior to delivery to the high-pressure continuous flow process chamber (cleaning chamber)** (see col 3, lines 4-12; lines 57-62; col 4, lines 52-54). Inoue et al. disclose that in a third stage a mixture of additives and co-solvents are added to the supercritical carbon dioxide in mixing unit 15 (by closing valve 10 following delivery of only supercritical carbon dioxide heated in heater 8 to the chamber 1 in a second stage) (see Figure 1) where the mixture of carbon dioxide, additives, and a co-solvent is then **further heated if necessary** (i.e., if necessary to reachieve supercriticality) (col 5, lines 9-27). Thus, Inoue et al. teaches that the addition of additives and co-solvent in the mixing tank 15 **may cause supercriticality to disappear**, in which case, the supplied cleaning mixture **is heated by heater 16 to reachieve supercriticality** prior to being delivered to the high pressure chamber (see col 5, lines 22-27).

The process of achieving supercriticality prior to delivery to the **pressurized continuous flow cleaning chamber** is further

explained in the rinsing stage (col 7, lines 29-31) where Inoue et al. **also teach (like the third stage)** that carbon dioxide and a co-solvent (no other additives) **are made supercritical by heater 16 prior to delivery to the continuous flow cleaning chamber** (col 7, lines 31-37).

Note that the flow path of the mixture (cleaning fluid) is from the mixing unit 15 through heater 16, and Inoue et al. nowhere teach that the cleaning fluid is transformed from a non-supercritical fluid to a supercritical fluid within the **pressurized continuous flow cleaning chamber. Indeed, such a process would make inoperable the continuous flow process of Inoue et al.**

Inoue et al. further disclose the use of "fluorides" as additives and disclose "fluorides" further containing a carbon atom (col 5, lines 54-col 6, line 4). Inoue also discloses the use of methanol, ethanol, and isopropanol as co-solvents (col 6, lines 20-22).

Thus Inoue et al. fail to disclose several elements of Applicants invention, including those elements in **bold type:**

"A method of cleaning substrates, comprising the steps

of:

providing a cleaning fluid;

mixing a solvent with said cleaning fluid to form a non-supercritical cleaning fluid mixture;

delivering said non-supercritical cleaning fluid mixture to a cleaning chamber;

forming a supercritical cleaning fluid from said non-supercritical cleaning fluid mixture in said cleaning chamber; and

contacting the substrate with said supercritical cleaning fluid in said cleaning chamber.

Thus, Inoue et al. is clearly insufficient to anticipate Applicants invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051,

1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Further with respect to claims 7 and 9 Inoue et al. nowhere disclose:

"wherein said supercritical cleaning fluid is non-conductive."

or

"wherein said cleaning fluid is selected from the group consisting of methane, ethane, propane, ammonia, nitric oxide, fluoromethane and difluoromethane."

Claim Rejections under 35 USC 103

2. Claims 3-4 stand rejected under 35 USC 103(a) as being unpatentable over Inoue et al., above.

Applicants reiterate the comments made above with respect to Inoue et al.

Examiner is mistaken in alleging that it would be obvious to modify Inoue et al. to achieve a specified contacting time since

the modifying the contacting time of the continuous flow supercritical flow cleaning process of Inoue et al. to achieve a contacting time or circulation of the cleaning fluid within the cleaning chamber of Inoue et al. would change the principle of operation **of the continuous flow supercritical flow cleaning process of Inoue et al.**

"**First**, there must be some **suggestion or motivation**, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second**, there must be a **reasonable expectation of success. Finally**, the prior art reference (or references when combined) **must teach or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).*

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)*.

3. Claims 10-13, 15, 17, and 19-24 stand rejected under 35 USC 103(a) as being unpatentable over Inoue et al., above, in view of Morita et al. (2002/0083959) and Vasartstra (6,242,165).

Applicants reiterate the comments made above with respect to Inoue et al.

Even assuming *arguendo* a proper motivation for combination, the fact that Morita et al. disclose forming a high dielectric constant film (BST) on a platinum thin film and then removing residual carbon compounds by supercritical carbon dioxide (or any substance other than carbon dioxide that has a sufficiently high ability to dissolve carbon compounds including water (see Abstract paragraph 0028; 0029; 0081; 0087), does not further help Examiner in producing Applicants invention.

Applicants further note that the broad catch-all disclosure

in paragraph 0089 also does not further help Examiner in providing any motive to modify Inoue et al. to achieve Applicants invention, and does not produce Applicants invention:

[0089] The inventive method is applicable to removing foreign matter from not only the dielectric film in a semiconductor device but also a conductor film or a semiconductor substrate in a semiconductor device or a component in a device of any other type. This is because the same effects **may** be attained in those cases **under appropriate conditions.**

In further contrast, Vaartstra discloses a method for removing organic material from a substrate using a **supercritical etching composition** including carbon dioxide and an oxidizer in a supercritical state where a nonsupercritical additive may be added to a chamber where the substrate is being exposed to a supercritical oxidizer (col 6, lines 23-37). The composition in a supercritical state is introduced into a pressureizeable chamber where the pressure and temperature are controlled **for maintaining at least one component of the composition in a supercritical state** (col 3, lines 49-63).

Vaartstra et al. disclose that a supercritical fluid component e.g., CO2 in the supercritical state may be added to a supercritical oxidizer; or a component not in a supercritical state may be added to a supercritical component either before or after it is brought into the supercritical state; or a component

not in a supercritical state may be provided into an etching chamber while the substrate is being exposed to the supercritical oxidizer component (col 6, lines 23-38). Vaartstra et al. also disclose that CO2 may be in a supercritical state while the oxidizer is not in a supercritical state (col 7, lines 64-66).

Vaartstra et al. also disclose that a mixing manifold (122; Figure 2) is used to mix components prior to their entry into the pressure vessel (col 9, lines 8-11) **where the components are heated in the mixing manifold such that at least one component is in a supercritical state in the mixing manifold (col 9, lines 19-26) prior to entering the pressure vessel.**

Vaartstra et al. **alternatively** disclose that the components **may be separately plumbed (unmixed) into the pressure vessel where the components are then mixed and are then brought into the supercritical state** (col 9, lines 31-35).

Further assuming *arguendo* a proper motivation for modifying the process of Inoue et al. with the disparate process of Vaartstra, without destroying the continuous supercritical flow process of Inoue et al. and making it unsuitable for its intended purpose, the further fact that Vaartstra discloses that a substrate assembly may included different substrates including

silicon-on-sapphire technology (SOS), silicon-on-insulator technology (SOI), **doped and undoped semiconductors,** epitaxial layers on silicon etc. (see col 4, lines 30-49), does not further help Examiner in producing Applicants invention.

"**First,** there must be some **suggestion or motivation,** either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. **Second,** there must be a **reasonable expectation of success. Finally,** the prior art reference (or references when combined) **must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

Conclusion

The cited references, individually or in combination, fail to produce Applicants invention and are therefore insufficient to make out a *prima facie* case of anticipation or obviousness with respect to Applicants disclosed and claimed invention.

The claims have been amended and new claims added to further clarify Applicants' disclosed and claimed invention. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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